New Jersey Stormwater Best Management Practice Manual

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http://www.state.nj.us/dep/watershedmgt/rules/bmpmanual2003.htm

CHAPTER 9.3

Standard for Dry Wells

Definition

A dry well is a subsurface storage facility that receives and temporarily stores roof runoff. Discharge of this stored runoff from a dry well occurs through infiltration into the surrounding soil. A dry well may be either a structural chamber and/or an excavated pit filled with aggregate. Due to the relatively low level of expected pollutants in roof runoff, a dry well cannot be used to comply with the suspended solids and nutrient removal requirements contained in the NJDEP's Stormwater Management Rules (N.J.A.C. 7:8). However, due to its storage capacity, a dry well may be used to reduce the total Stormwater Quality Storm runoff volume that a roof would ordinarily discharge to downstream stormwater management facilities.

Purpose

While generally not a significant source of runoff pollution, roofs are one of the most important sources of new or increased runoff from land development sites. Dry well storage is used to enhance water quality by storing and infiltrating roof runoff, thus reducing the amount of Stormwater Quality Storm runoff volume to be treated by the other stormwater management facilities on the site. As such, dry wells should be used primarily to reduce runoff from residential, commercial, institutional or industrial roof tops.

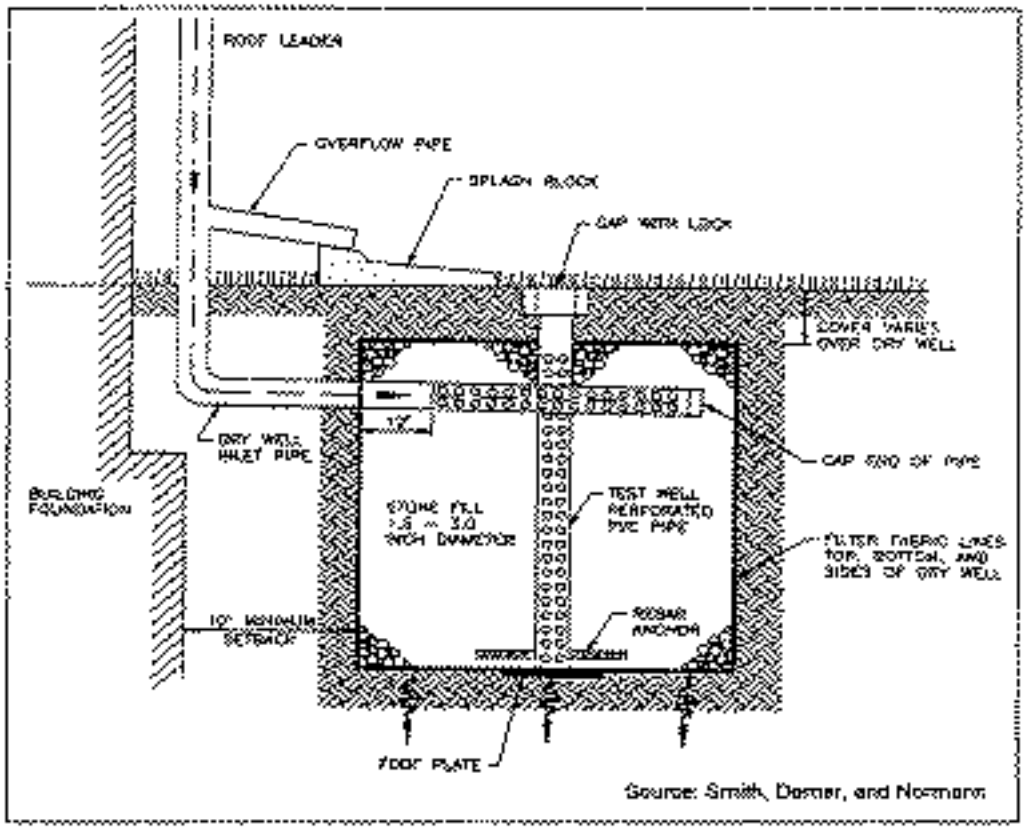
Conditions Where Practice Applies

A dry well is used to capture and store runoff from roofs. The total contributing surface area shall be a maximum of one acre or less per dry well. The use of dry wells is applicable only where the surrounding soil is sufficiently permeable to allow a reasonable rate of infiltration. As an infiltration type facility, a dry well is not appropriate for roofs where high pollutant or sediment loading is anticipated due to the potential for groundwater contamination. Like other infiltration and recharge systems, dry wells shall not be used in the following locations:

1. In industrial and commercial areas where petroleum products, herbicides, pesticides, or solvents may be loaded/unloaded, stored, or applied within the drainage area, especially locations with soluble heavy metals and toxic organics in the runoff;

2. Where hazardous materials are expected to be present in greater than 'reportable quantities' as defined by the U.S. Environmental Protection Agency (EPA) in the Code of Federal Regulations (40 CFR 302.4);
3. For sites with high risks for spills of toxic materials such as gas stations and vehicle maintenance facilities;
4. Where industrial stormwater runoff is exposed to source material. Source material means any material(s) or machinery, located at an industrial facility that is directly or indirectly related to process, manufacturing or other industrial activities, that could be a source of pollutants in any industrial stormwater discharge to groundwater. Source materials include, but are not limited to: raw materials; intermediate products; final products; waste materials; by-products; industrial machinery and fuels; and lubricants, solvents, and detergents that are related to process, manufacturing, or other industrial activities that are exposed to stormwater;
5. Where the soil around and below the dry well does not have the necessary permeability to infiltrate the entire Stormwater Quality Storm runoff volume; or
6. Where dry well installation would create a significant risk for basement seepage or adversely impact a septic system's disposal field.

Figure 9.3-1: Dry Well Components



Design Criteria

The basic design parameters for a dry well are its storage volume and the infiltration rate of the surrounding soil. A dry well must have sufficient storage volume to contain the design runoff volume without overflow, while the soil's infiltration rate must be sufficient to drain the stored runoff within 72 hours. Details of these and other design parameters are presented below. The components of a typical dry well are shown above in Figure 9.3-1.

A. Storage Volume, Depth, and Duration

A dry well shall be designed to treat the runoff volume generated by the 1.25-Inch/2-Hour Stormwater Quality Storm. Techniques to compute this volume are discussed in Chapter 5. A dry well must also all fully drain this runoff volume within 72 hours. Runoff storage in a dry well for greater times can render it ineffective and may result in anaerobic conditions, odor, and both water quality and mosquito breeding problems. The bottom of the dry well must be at least 3 feet above seasonal high water table or bedrock.

B. Infiltration Rates

The minimum design infiltration rate of the surrounding soil is 0.5 inches per hour. Suitable soil types include sand, sandy loam, loamy sand and gravel. Soils with high clay or silt content shall not be utilized for dry wells. The infiltration rate must be determined by field or laboratory testing. However, since the actual infiltration rate may vary from test results and may also decrease over time due to the accumulation of sediments removed from the stormwater, a factor of safety of two shall be applied to the tested infiltration rate to determine the design infiltration rate. Therefore, if the tested infiltration rate of the soil bed material is 2 inches/hour, the design rate would be 2 inches per hour (= 4 inches per hour/2). This rate would then be compared to both the 0.5 inch per minimum design rate and the rate necessary to drain the entire Stormwater Quality Storm runoff volume.

C. Drainage Area

The maximum drainage area to a dry well is 1 acre.

D. Overflows

All dry wells must be able to safely convey system overflows to downstream drainage systems. The capacity of the overflow must be consistent with the remainder of the site's drainage system and sufficient to provide safe, stable discharge of stormwater in the event of an overflow. The downstream drainage system must have sufficient capacity to convey the overflow from the dry well.

Operation and Maintenance

Effective dry well performance requires proper operation and regular maintenance. Chapter 8 provides information and requirements for preparing an Operation and Maintenance Plan for stormwater management facilities, including dry wells. Specific operation and maintenance requirements for dry wells are presented below. These requirements must be included in the system's Operations and Maintenance Plan.

General Maintenance

A dry well should be inspected at least four times annually as well as after every storm exceeding 1 inch of rainfall. The water level in the test well should be the primary means of measuring infiltration rates and drain times. Pumping stored runoff from an impaired or failed dry well can also be accomplished through the test well. Therefore, adequate inspection and maintenance access to the test well must be provided.

Other Maintenance Criteria

The Operation and Maintenance Plan must indicate the approximate time that the system would normally take to drain the Stormwater Quality Storm runoff volume from the dry well. This normal drain time should then be used to evaluate the dry well's actual performance. If significant increases in the drain time are observed or if it exceeds the 72 hour maximum, appropriate measures must be taken to comply with the drain time requirements and maintain the proper functioning of the dry well.

Considerations

A. Overflows

Provisions must be made to safely convey excess runoff from storms greater than the Stormwater Quality Storm away from the dry well and roofed structure to reduce the possibility of basement seepage. This may be accomplished through positive grading or a corrugated perforated conduit to a suitable outlet.

B. Construction

1. A dry well must not be placed into service until the drainage area is stabilized.
2. Excavated material should be placed away from the excavated sides to prevent wall instability during excavation and backfilling. Large tree roots should be trimmed flush with the sides to prevent puncturing or tearing of filter fabric during installation. The side walls should be roughened where sheared and sealed by heavy equipment. Care should be exercised to prevent natural or fill soils from mixing with drainage aggregate. All contaminated aggregate must be removed and replaced with clean material.
3. Vertically excavated trench walls may be difficult to maintain in areas where soil moisture is high or where soft cohesive or cohesionless soils predominate. These conditions may require laying back of the side slopes to maintain stability.
4. The bottom, sides and top of the well surface shall be lined with filter fabric with sufficiently small pore space to effectively prohibit the passage of the smallest soil particle found in the native soil profile. Only non-woven filter fabrics shall be used. Installation of the fabric shall provide sufficient length to cover the floor, sides and top of the aggregate. Fabric shall be wrapped over the top of the aggregate fill such that the fill shall be completely enclosed. The fabric shall be wrapped and tied with wire or nylon twine or otherwise tightly secured around the horizontal inflow pipe where the pipe protrudes through the fabric. Fabric shall be overlapped six inches in "shingle" fashion when more than one section is required to enclose the aggregate. The aggregate fill shall be placed to within 12 inches of the finished surface elevation, leaving sufficient depth for topsoil placement (in areas where surface stabilization is accomplished through the use of vegetation).

5. Drainage aggregate should be placed in lifts and compacted using plate compactors. A maximum loose lift thickness of 12 inches is recommended. The compaction process ensures fabric conformity to the excavation sides, reducing potential for soil piping and fabric clogging. Voids between the fabric and excavation sides due to boulders or other obstacles should be avoided. Natural soils should be placed in these voids during construction to ensure fabric conformity to excavation sides.

References under review.